FIG.1

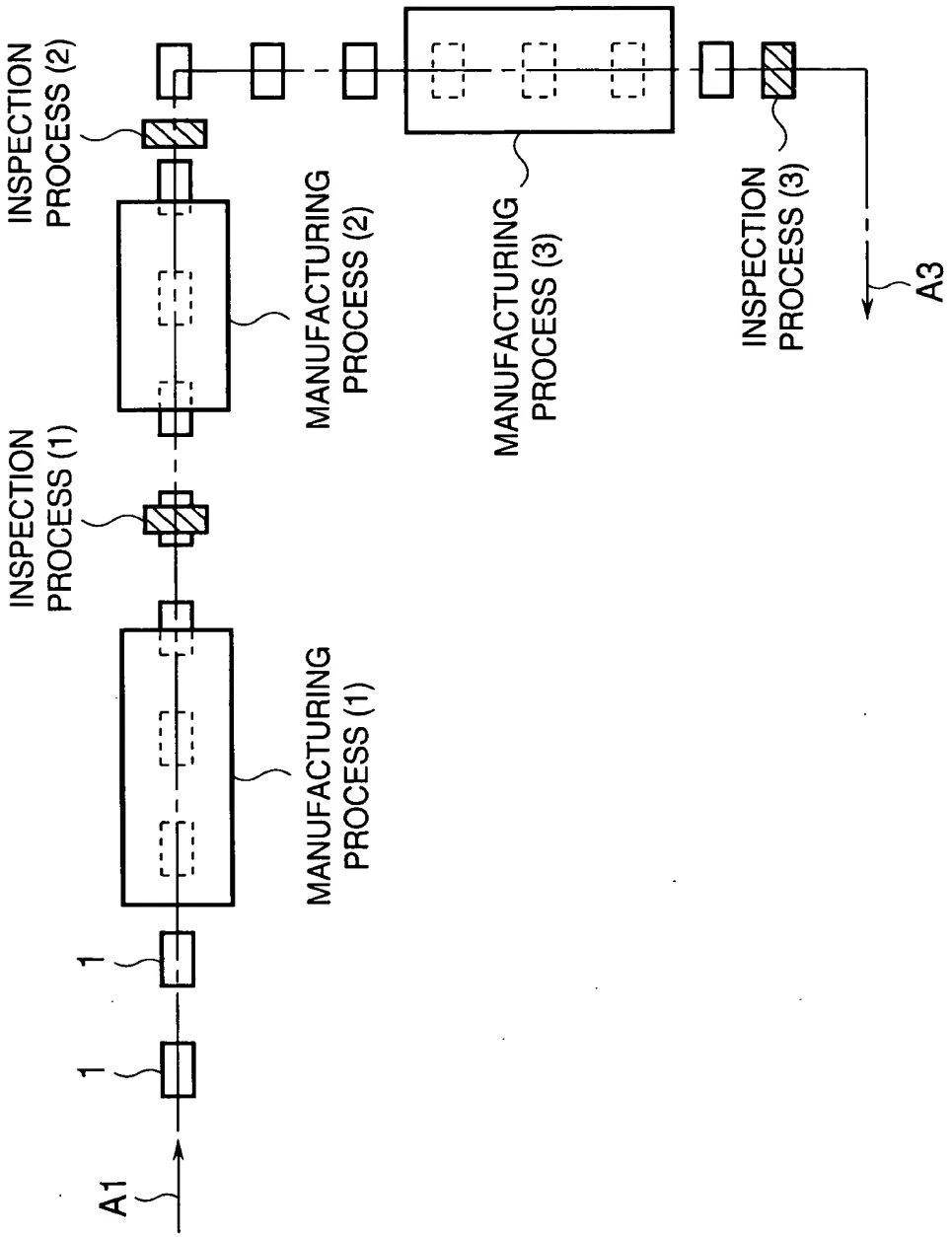

A1
1
1
MANUFACTURING PROCESS (1)
INSPECTION PROCESS (1)
MANUFACTURING PROCESS (2)
INSPECTION PROCESS (2)
MANUFACTURING PROCESS (3)
INSPECTION PROCESS (3)
A3

FIG.2

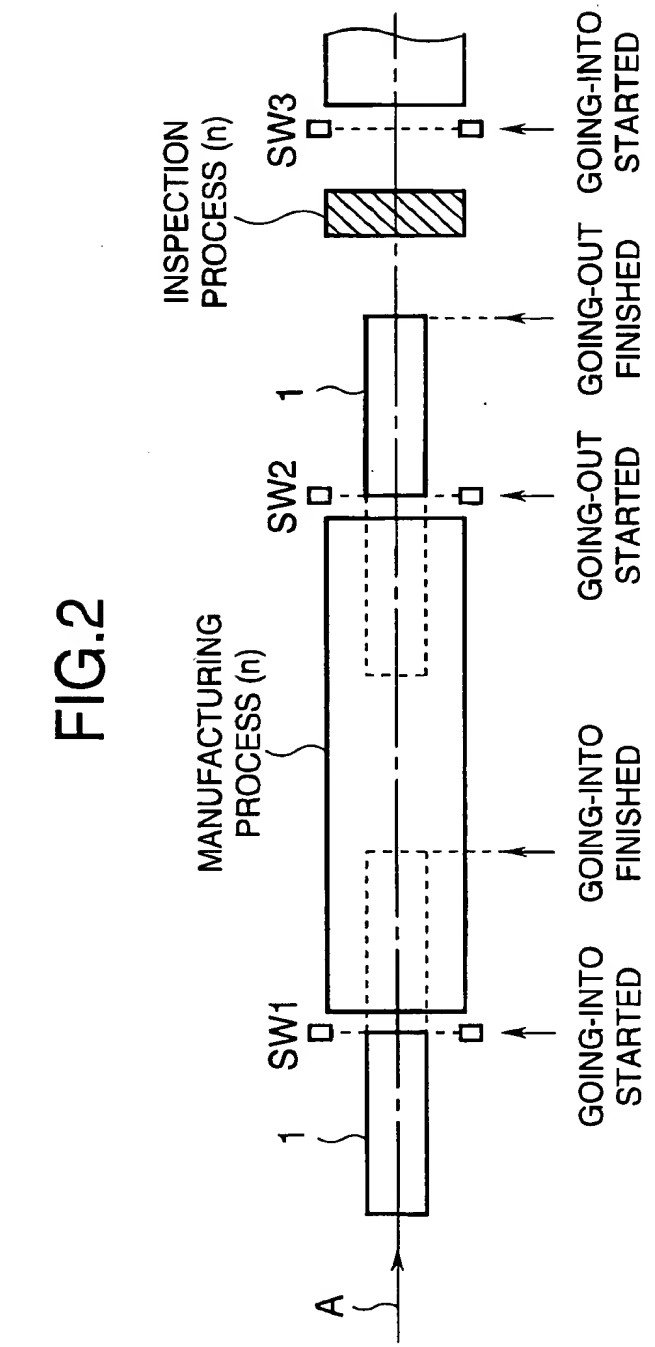

A
1
SW1
GOING-INTO STARTED
MANUFACTURING PROCESS (n)
GOING-INTO FINISHED
1
SW2
GOING-OUT STARTED
INSPECTION PROCESS (n)
GOING-OUT FINISHED
SW3
GOING-INTO STARTED

FIG.3

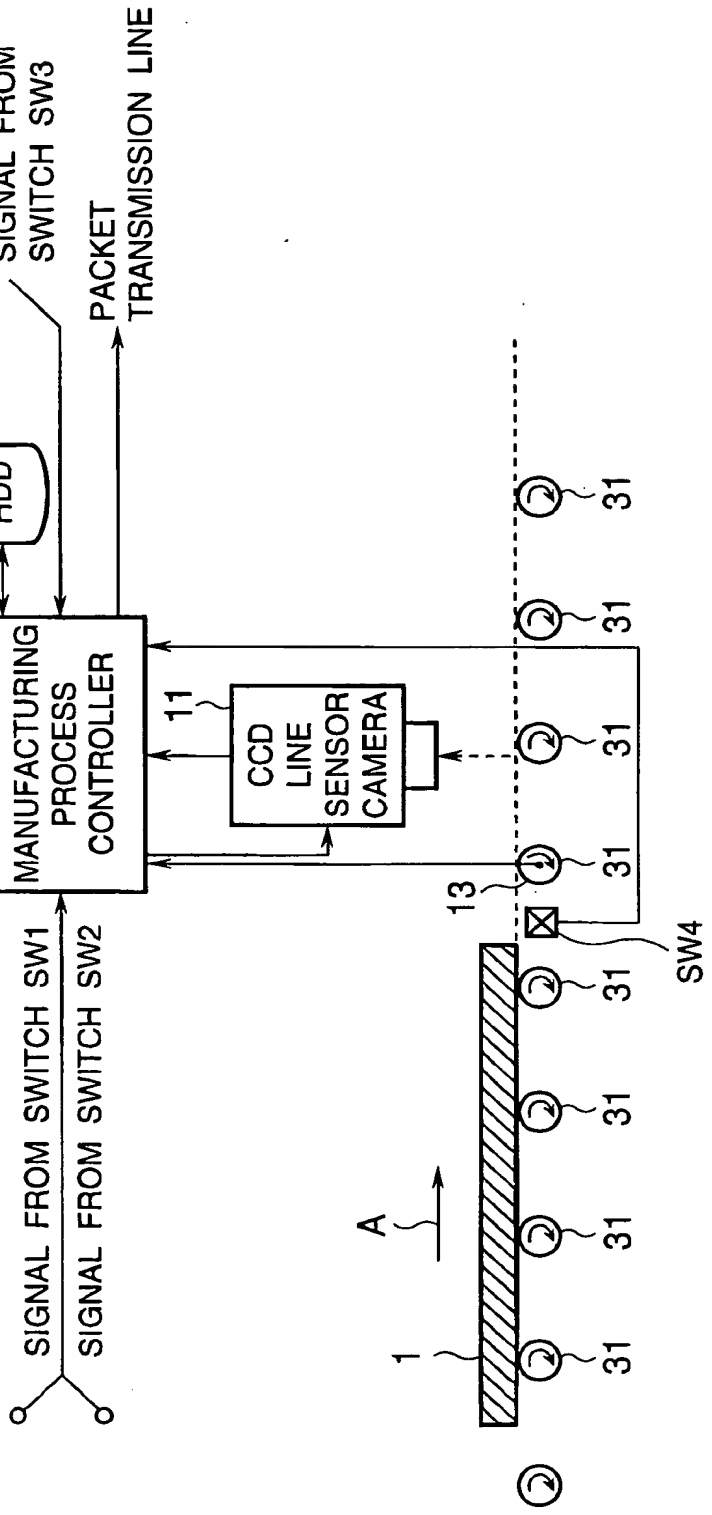

SIGNAL FROM SWITCH SW3
PACKET TRANSMISSION LINE
16
HDD
100
MANUFACTURING PROCESS CONTROLLER
11
CCD LINE SENSOR CAMERA
SIGNAL FROM SWITCH SW1
SIGNAL FROM SWITCH SW2
13
SW4
A
1
31

FIG.4A

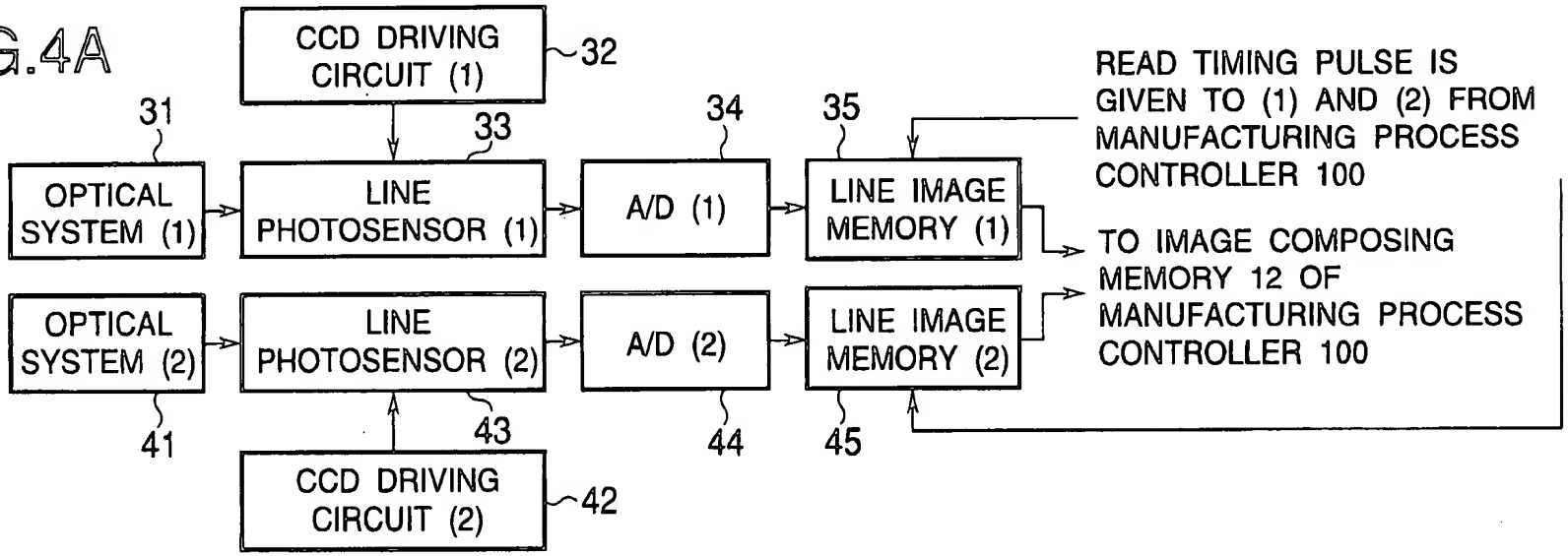

CCD DRIVING CIRCUIT (1)
32
31
33
34
35
OPTICAL SYSTEM (1)
LINE PHOTOSENSOR (1)
A/D (1)
LINE IMAGE MEMORY (1)
READ TIMING PULSE IS GIVEN TO (1) AND (2) FROM MANUFACTURING PROCESS CONTROLLER 100
TO IMAGE COMPOSING MEMORY 12 OF MANUFACTURING PROCESS CONTROLLER 100
OPTICAL SYSTEM (2)
LINE PHOTOSENSOR (2)
A/D (2)
LINE IMAGE MEMORY (2)
41
43
44
45
CCD DRIVING CIRCUIT (2)
42

FIG.4B

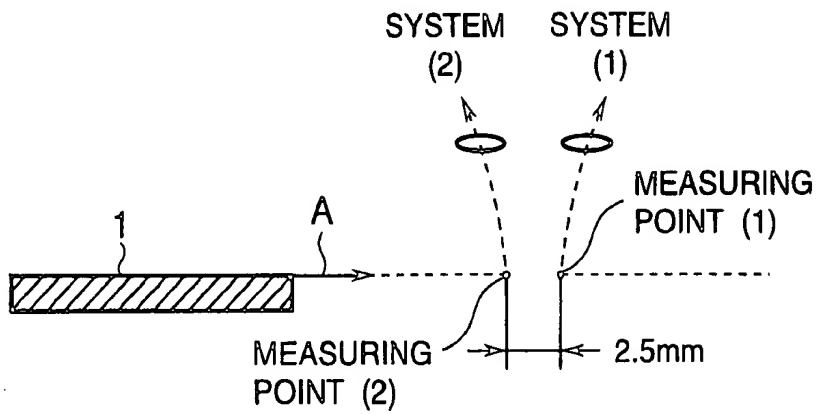

SYSTEM (2)
SYSTEM (1)
MEASURING POINT (1)
1
A
MEASURING POINT (2)
2.5mm

FIG.5

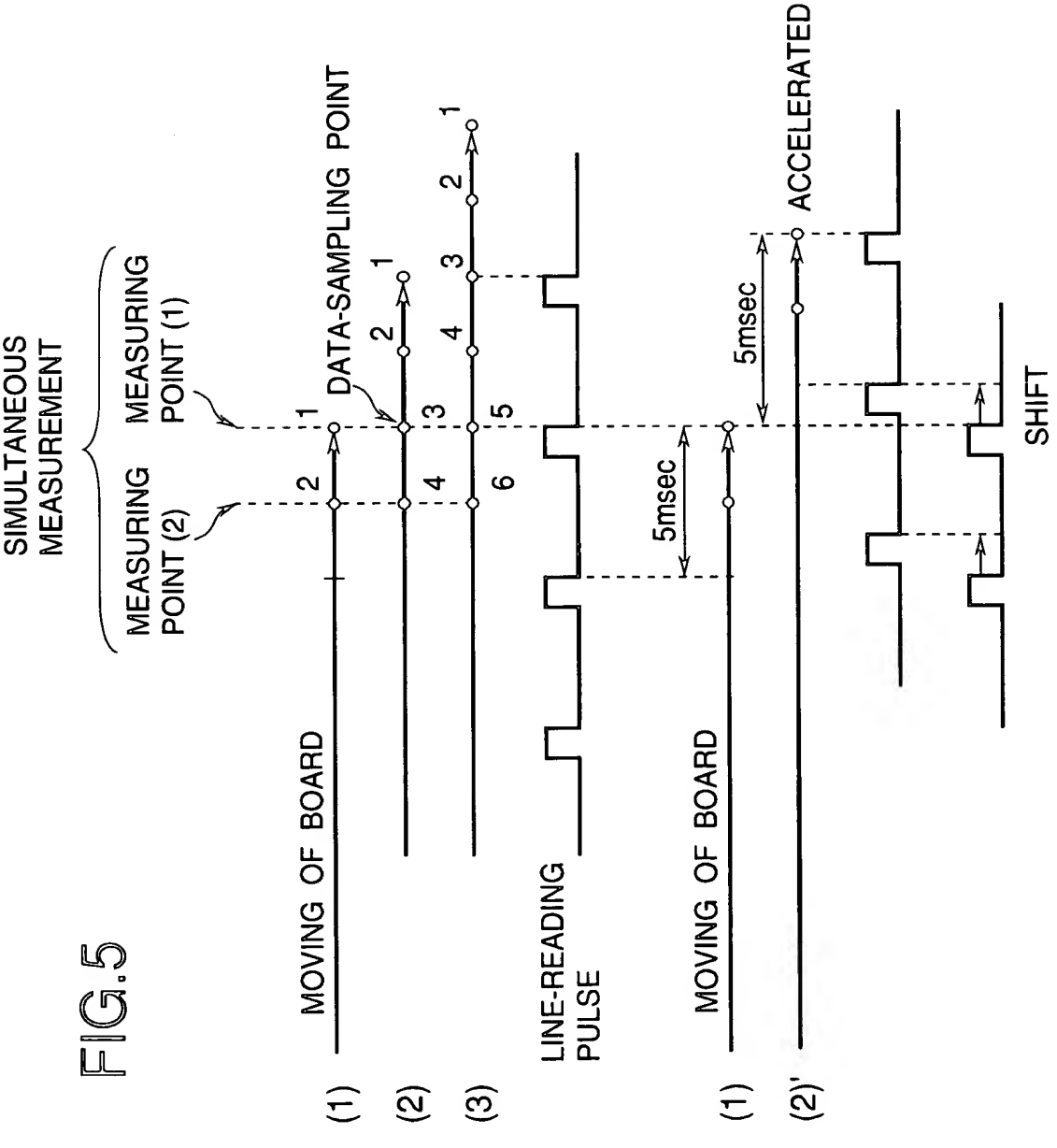

SIMULTANEOUS MEASUREMENT
MEASURING POINT (1)
MEASURING POINT (2)
DATA-SAMPLING POINT
MOVING OF BOARD
LINE-READING PULSE
5msec
ACCELERATED
SHIFT
(1)
(2)
(3)
(1)
(2)'

FIG.6

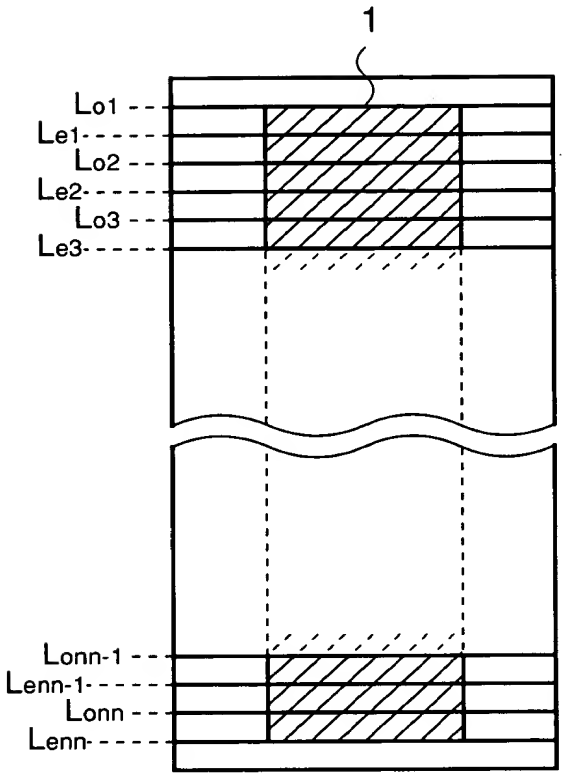


FIG.7A

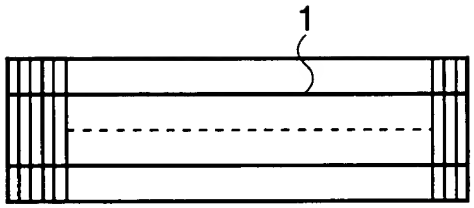


FIG.7B

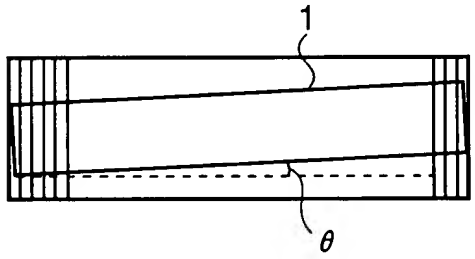


FIG.7C

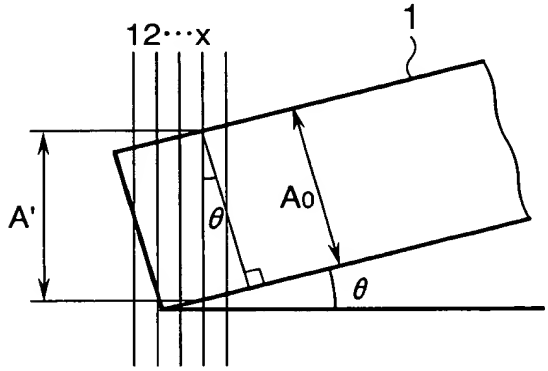


FIG.8A

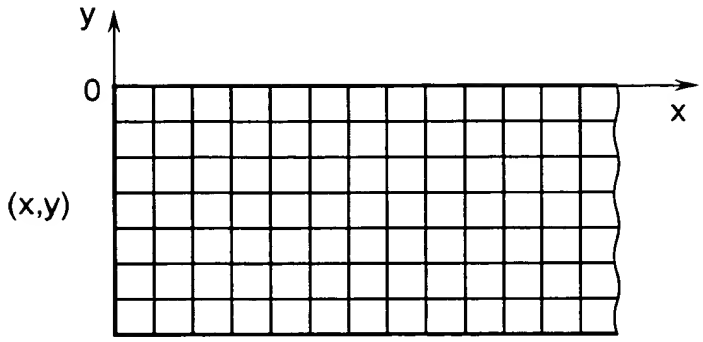


FIG.8B

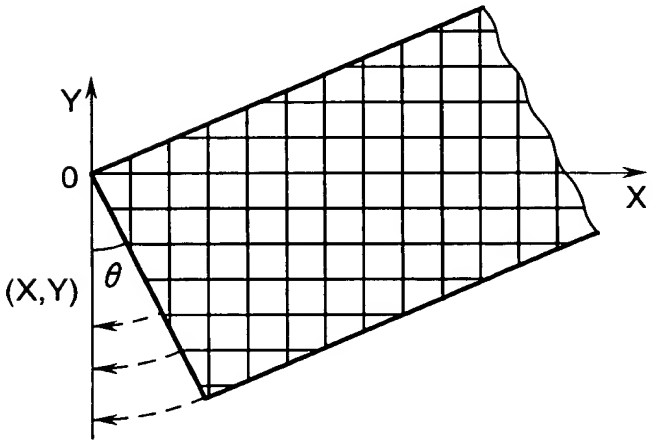
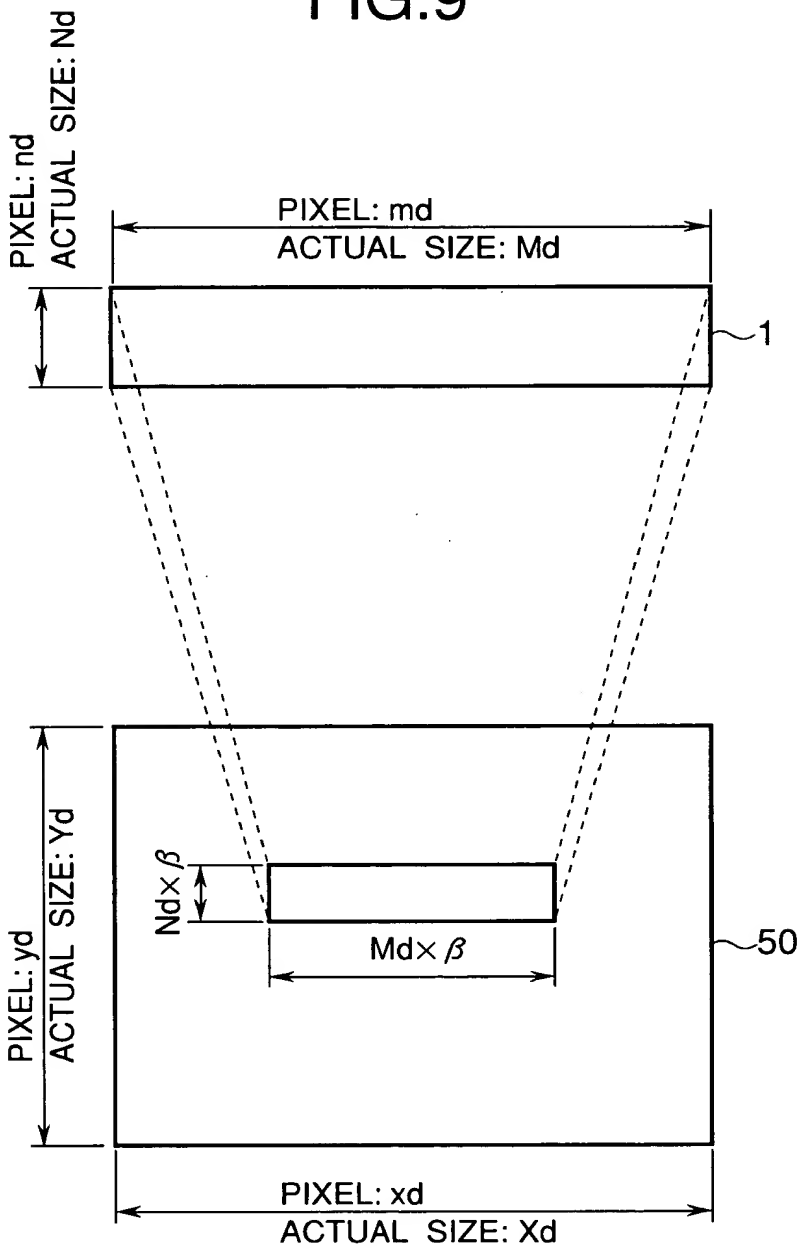


FIG.9


PIXEL: nd
ACTUAL SIZE: Nd
PIXEL: md
ACTUAL SIZE: Md
1
PIXEL: yd
ACTUAL SIZE: Yd
Nd× β
Md× β
50
PIXEL: xd
ACTUAL SIZE: Xd

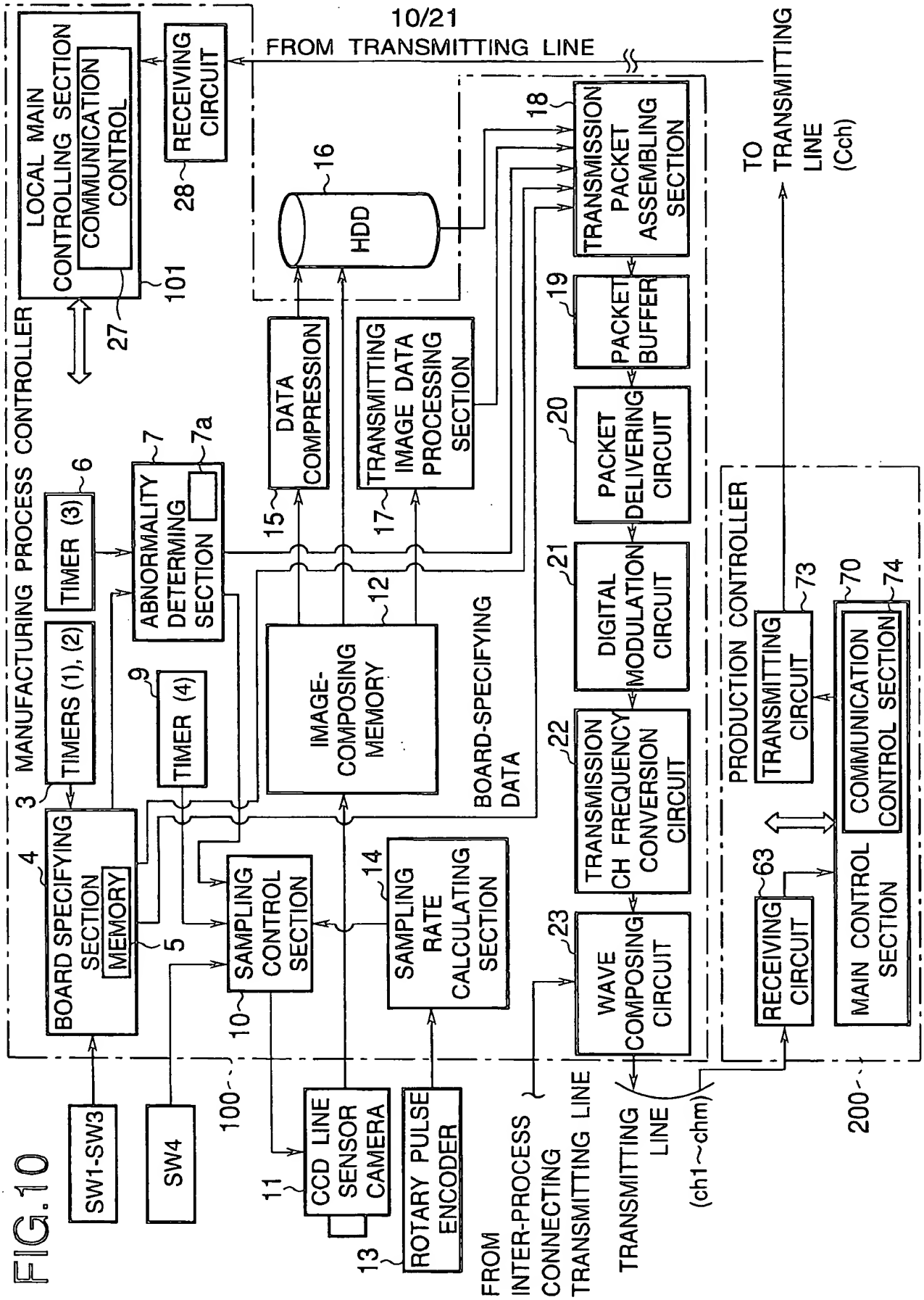

MANUFACTURING PROCESS CONTROLLER
LOCAL MAIN CONTROLLING SECTION
COMMUNICATION CONTROL
RECEIVING CIRCUIT
FROM TRANSMITTING LINE
TO TRANSMITTING LINE (Cch)
HDD
TRANSMISSION PACKET ASSEMBLING SECTION
PACKET BUFFER
PACKET DELIVERING CIRCUIT
DIGITAL MODULATION CIRCUIT
TRANSMISSION CH FREQUENCY CONVERSION CIRCUIT
WAVE COMPOSING CIRCUIT
DATA COMPRESSION
TRANSMITTING IMAGE DATA PROCESSING SECTION
IMAGE-COMPOSING MEMORY
BOARD-SPECIFYING DATA
ABNORMALITY DETERMING SECTION
TIMER (3)
TIMERS (1), (2)
TIMER (4)
BOARD SPECIFYING SECTION
MEMORY
SAMPLING CONTROL SECTION
SAMPLING RATE CALCULATING SECTION
PRODUCTION CONTROLLER
TRANSMITTING CIRCUIT
RECEIVING CIRCUIT
COMMUNICATION CONTROL SECTION
MAIN CONTROL SECTION
SW1-SW3
SW4
CCD LINE SENSOR CAMERA
ROTARY PULSE ENCODER
FROM INTER-PROCESS CONNECTING TRANSMITTING LINE
TRANSMITTING LINE (ch1~chm)
100
200
101
27
28
3
4
5
6
7
7a
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
63
70
73
74

FIG.10

FIG.11

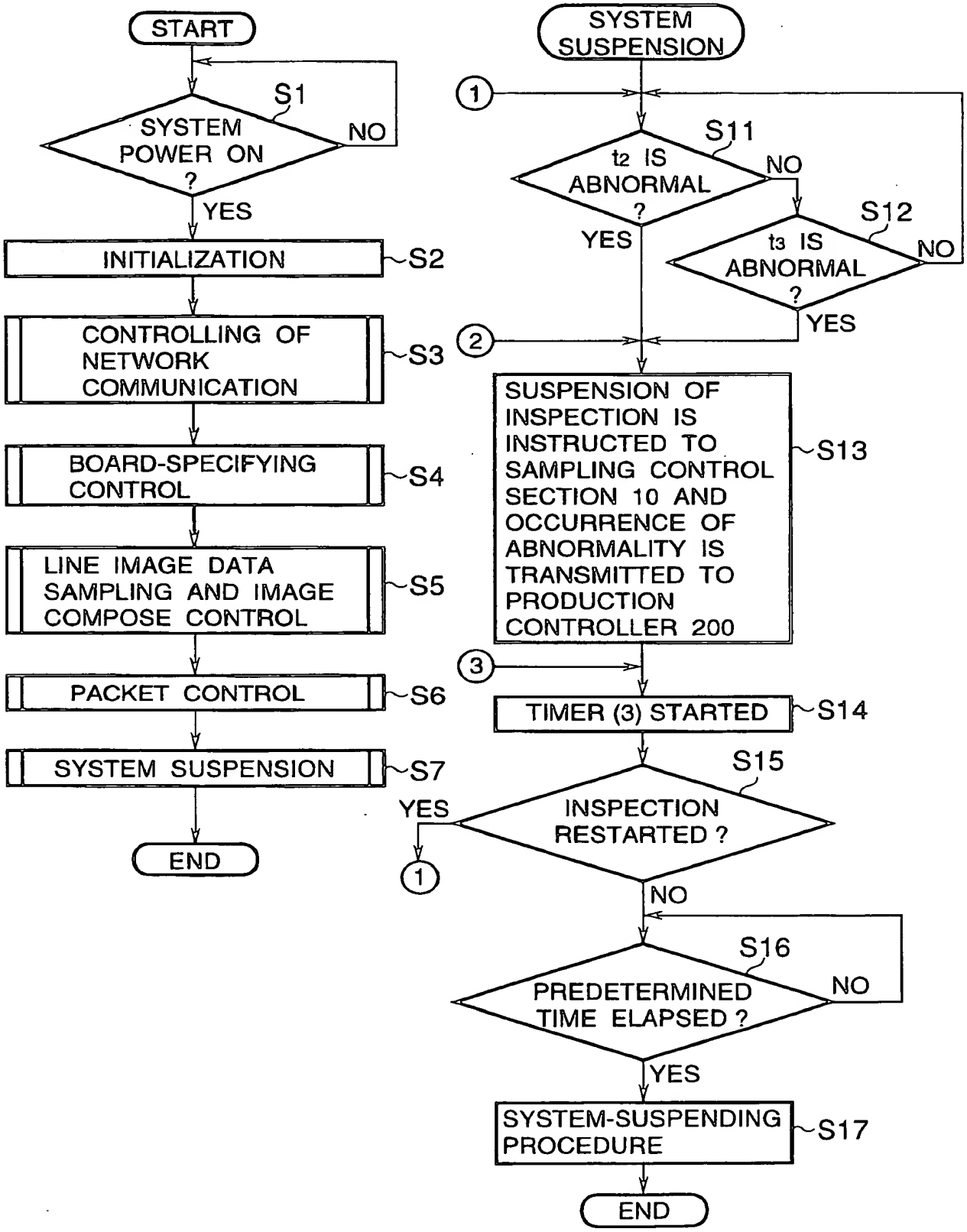

START
S1
SYSTEM POWER ON ?
NO
YES
INITIALIZATION
S2
CONTROLLING OF NETWORK COMMUNICATION
S3
BOARD-SPECIFYING CONTROL
S4
LINE IMAGE DATA SAMPLING AND IMAGE COMPOSE CONTROL
S5
PACKET CONTROL
S6
SYSTEM SUSPENSION
S7
END
SYSTEM SUSPENSION
1
S11
t2 IS ABNORMAL ?
NO
YES
S12
t3 IS ABNORMAL ?
NO
YES
2
SUSPENSION OF INSPECTION IS INSTRUCTED TO SAMPLING CONTROL SECTION 10 AND OCCURRENCE OF ABNORMALITY IS TRANSMITTED TO PRODUCTION CONTROLLER 200
S13
3
TIMER (3) STARTED
S14
S15
INSPECTION RESTARTED ?
YES
1
NO
S16
PREDETERMINED TIME ELAPSED ?
NO
YES
SYSTEM-SUSPENDING PROCEDURE
S17
END

FIG.12

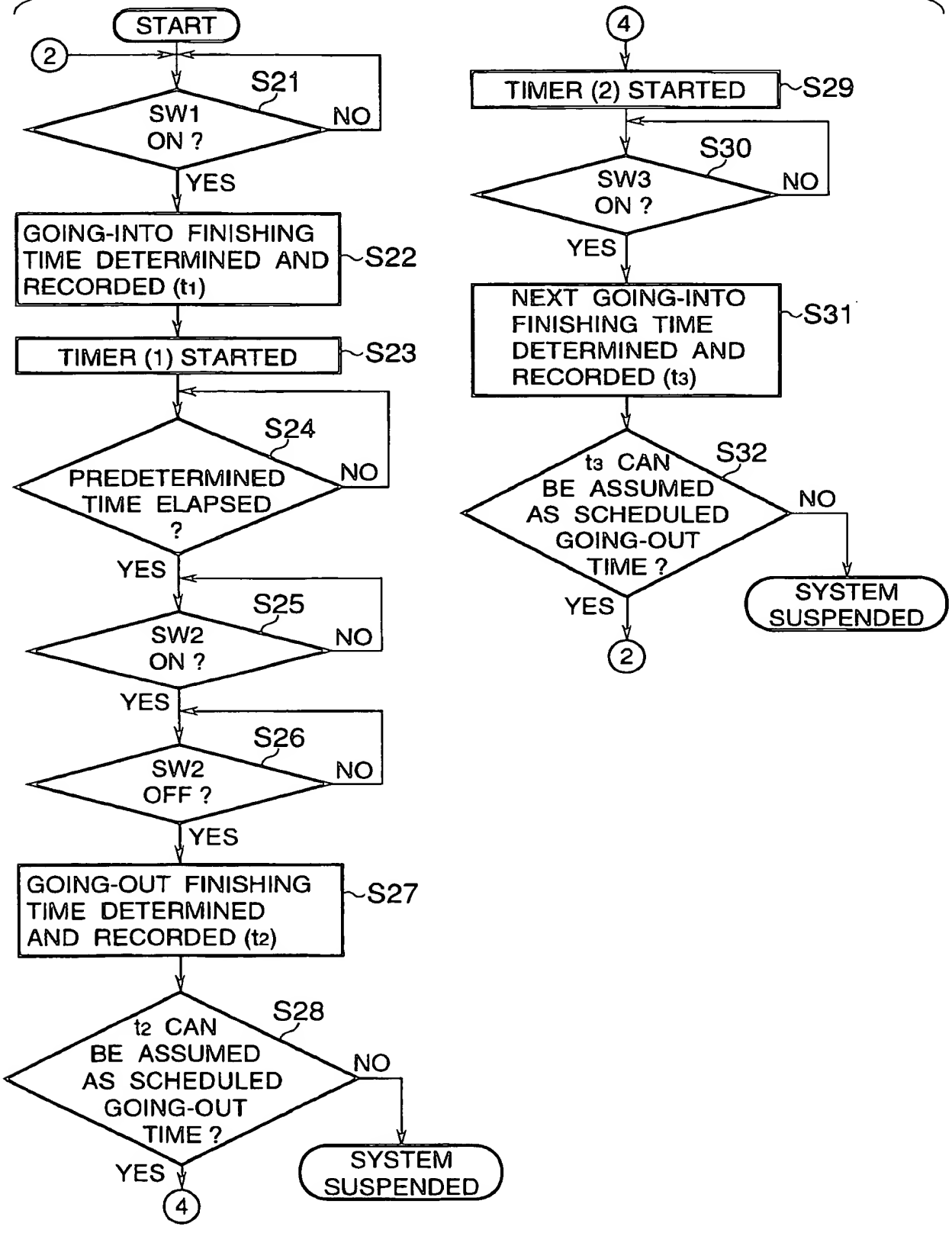

START
2
S21
SW1 ON ?
NO
YES
GOING-INTO FINISHING TIME DETERMINED AND RECORDED (t1)
S22
TIMER (1) STARTED
S23
S24
PREDETERMINED TIME ELAPSED ?
NO
YES
S25
SW2 ON ?
NO
YES
S26
SW2 OFF ?
NO
YES
GOING-OUT FINISHING TIME DETERMINED AND RECORDED (t2)
S27
S28
t2 CAN BE ASSUMED AS SCHEDULED GOING-OUT TIME ?
NO
YES
SYSTEM SUSPENDED
4
4
TIMER (2) STARTED
S29
S30
SW3 ON ?
NO
YES
NEXT GOING-INTO FINISHING TIME DETERMINED AND RECORDED (t3)
S31
S32
t3 CAN BE ASSUMED AS SCHEDULED GOING-OUT TIME ?
NO
YES
SYSTEM SUSPENDED
2

FIG.13

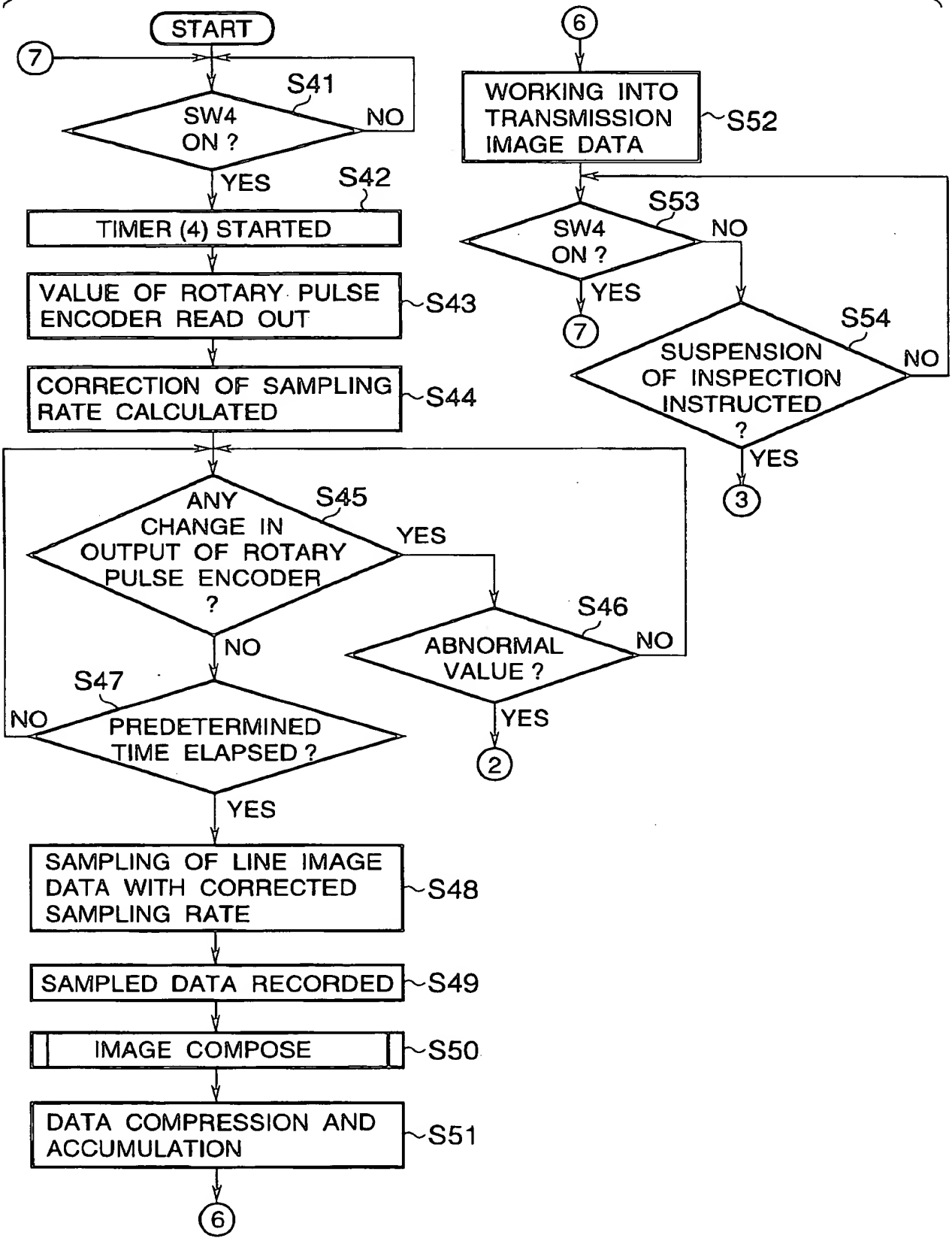

START
7
S41
SW4 ON ?
NO
YES
S42
TIMER (4) STARTED
VALUE OF ROTARY PULSE ENCODER READ OUT
S43
CORRECTION OF SAMPLING RATE CALCULATED
S44
ANY CHANGE IN OUTPUT OF ROTARY PULSE ENCODER ?
S45
YES
NO
S47
NO
PREDETERMINED TIME ELAPSED ?
YES
SAMPLING OF LINE IMAGE DATA WITH CORRECTED SAMPLING RATE
S48
SAMPLED DATA RECORDED
S49
IMAGE COMPOSE
S50
DATA COMPRESSION AND ACCUMULATION
S51
6
6
WORKING INTO TRANSMISSION IMAGE DATA
S52
S53
SW4 ON ?
NO
YES
7
S54
SUSPENSION OF INSPECTION INSTRUCTED ?
NO
YES
3
S46
ABNORMAL VALUE ?
NO
YES
2

FIG.14

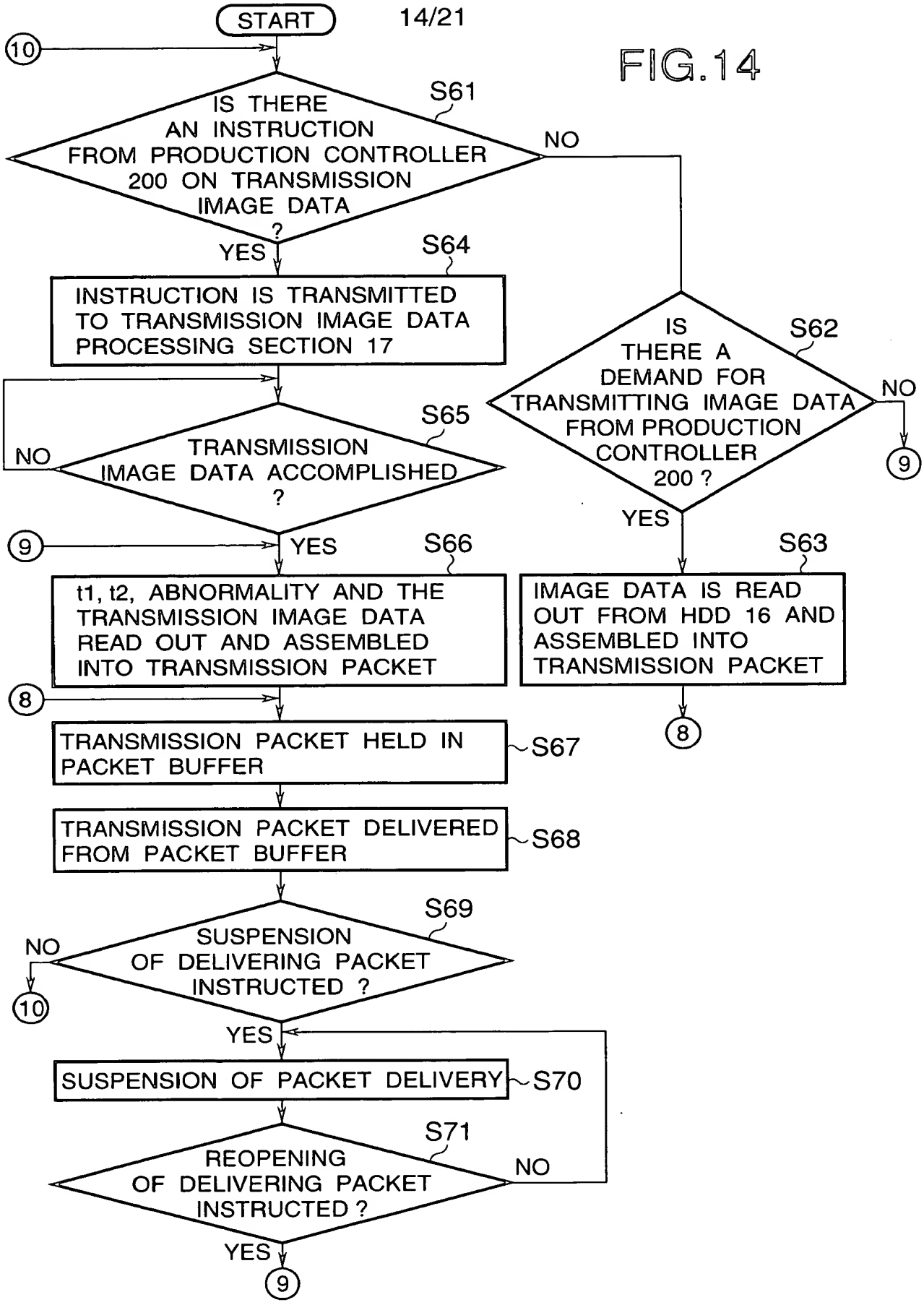
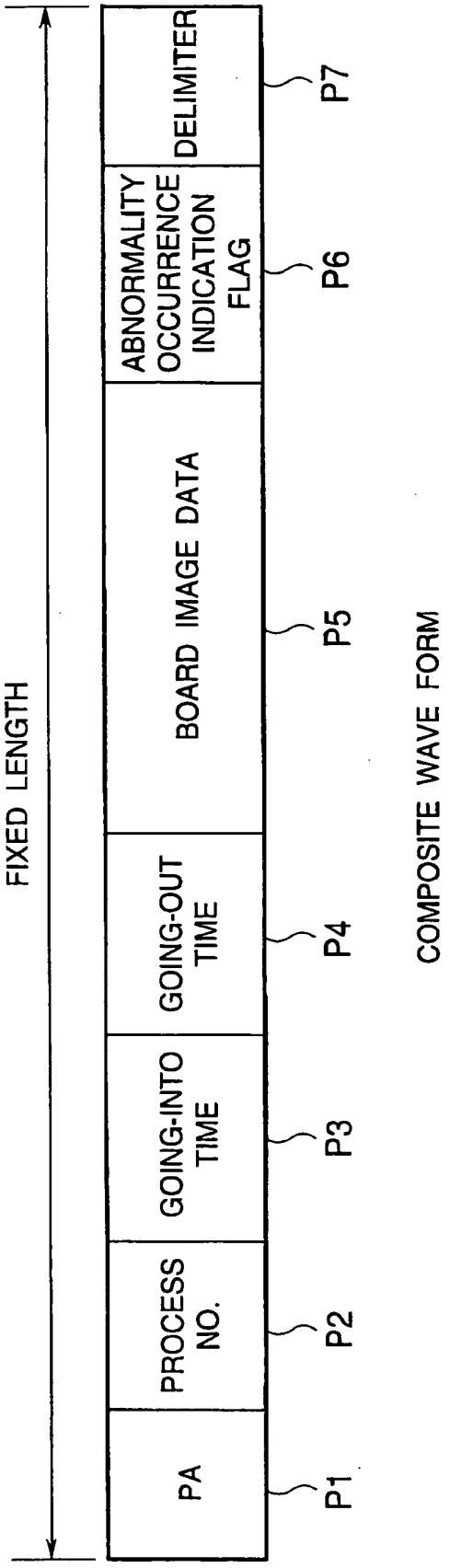

START
10
S61
IS THERE AN INSTRUCTION FROM PRODUCTION CONTROLLER 200 ON TRANSMISSION IMAGE DATA ?
NO
YES
S64
INSTRUCTION IS TRANSMITTED TO TRANSMISSION IMAGE DATA PROCESSING SECTION 17
S62
IS THERE A DEMAND FOR TRANSMITTING IMAGE DATA FROM PRODUCTION CONTROLLER 200 ?
NO
9
S65
TRANSMISSION IMAGE DATA ACCOMPLISHED ?
NO
9
YES
S66
t1, t2, ABNORMALITY AND THE TRANSMISSION IMAGE DATA READ OUT AND ASSEMBLED INTO TRANSMISSION PACKET
YES
S63
IMAGE DATA IS READ OUT FROM HDD 16 AND ASSEMBLED INTO TRANSMISSION PACKET
8
8
TRANSMISSION PACKET HELD IN PACKET BUFFER
S67
TRANSMISSION PACKET DELIVERED FROM PACKET BUFFER
S68
S69
SUSPENSION OF DELIVERING PACKET INSTRUCTED ?
NO
10
YES
SUSPENSION OF PACKET DELIVERY
S70
S71
REOPENING OF DELIVERING PACKET INSTRUCTED ?
NO
YES
9

FIG.15


FIXED LENGTH
PA
PROCESS NO.
GOING-INTO TIME
GOING-OUT TIME
BOARD IMAGE DATA
ABNORMALITY OCCURRENCE INDICATION FLAG
DELIMITER
P1
P2
P3
P4
P5
P6
P7
COMPOSITE WAVE FORM

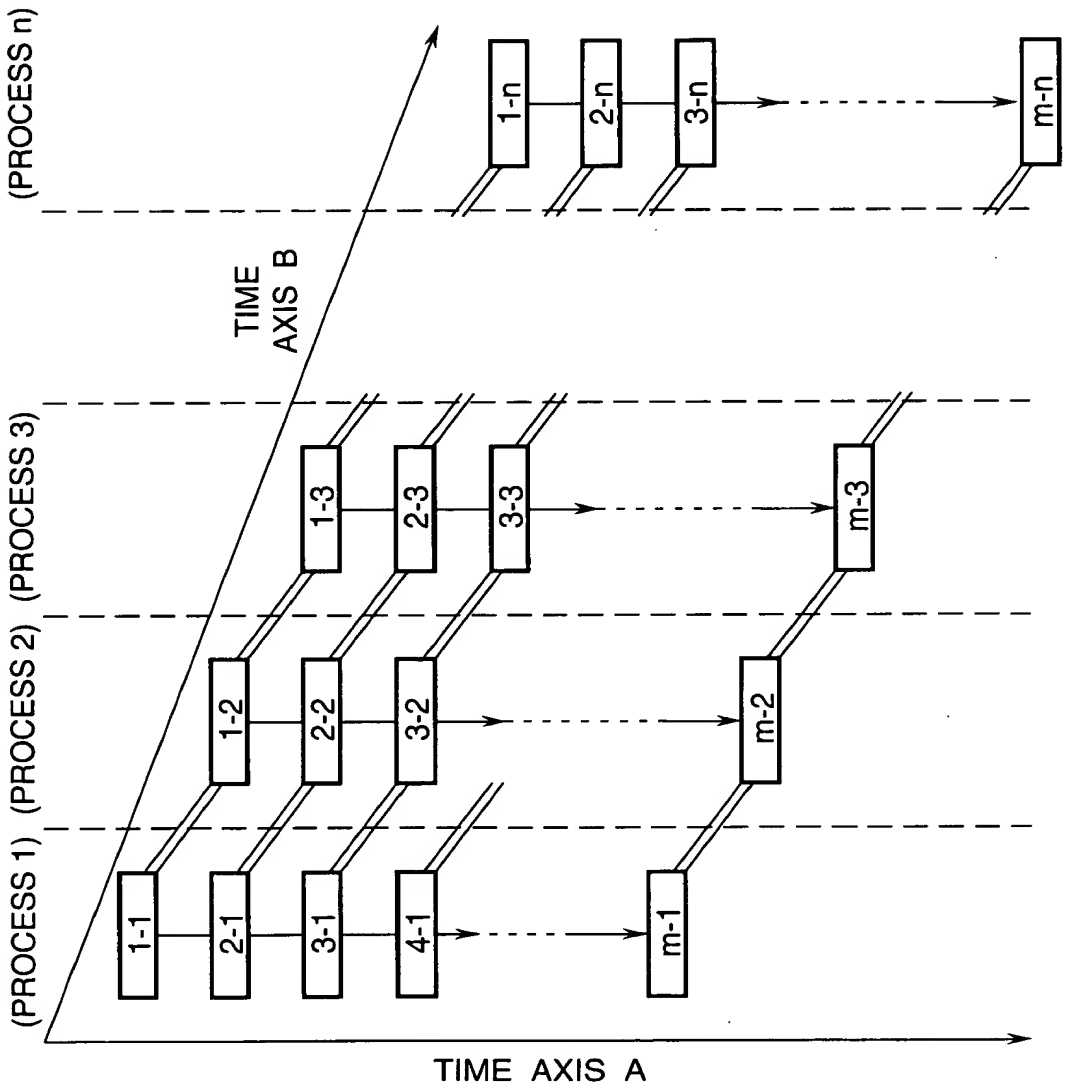

(PROCESS n)
(PROCESS 3)
(PROCESS 2)
(PROCESS 1)
TIME AXIS B
TIME AXIS A
1-n
2-n
3-n
m-n
1-3
2-3
3-3
m-3
1-2
2-2
3-2
m-2
1-1
2-1
3-1
4-1
m-1

FIG.16

FIG.17

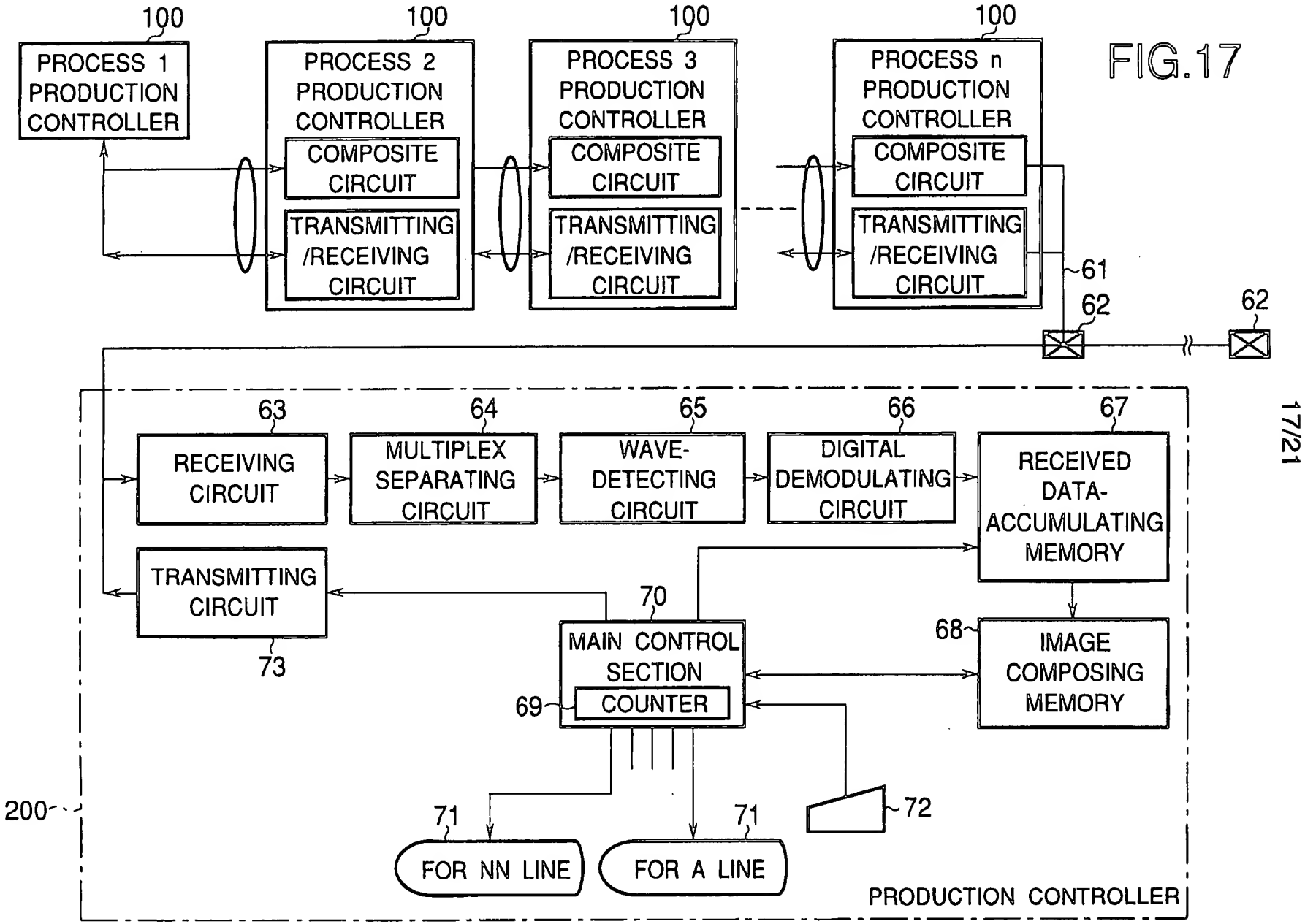

100
PROCESS 1 PRODUCTION CONTROLLER
100
PROCESS 2 PRODUCTION CONTROLLER
COMPOSITE CIRCUIT
TRANSMITTING /RECEIVING CIRCUIT
100
PROCESS 3 PRODUCTION CONTROLLER
COMPOSITE CIRCUIT
TRANSMITTING /RECEIVING CIRCUIT
100
PROCESS n PRODUCTION CONTROLLER
COMPOSITE CIRCUIT
TRANSMITTING /RECEIVING CIRCUIT
61
62
62
63
RECEIVING CIRCUIT
64
MULTIPLEX SEPARATING CIRCUIT
65
WAVE-DETECTING CIRCUIT
66
DIGITAL DEMODULATING CIRCUIT
67
RECEIVED DATA-ACCUMULATING MEMORY
TRANSMITTING CIRCUIT
73
70
MAIN CONTROL SECTION
COUNTER
69
68
IMAGE COMPOSING MEMORY
200
71
71
72
FOR NN LINE
FOR A LINE
PRODUCTION CONTROLLER

FIG.18

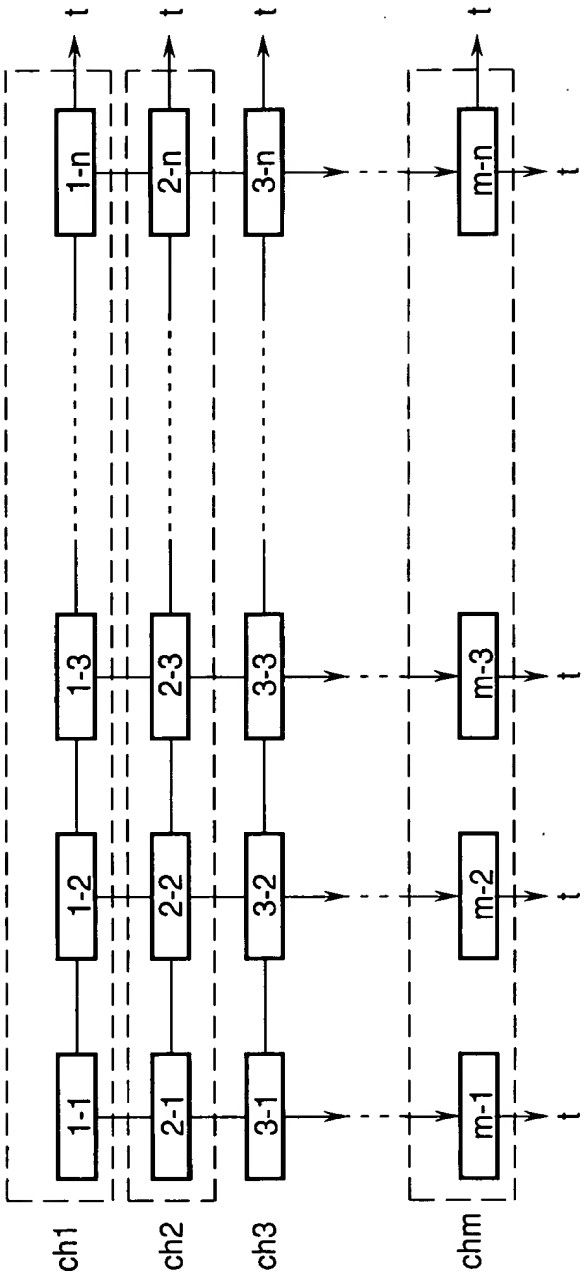


FIG.19

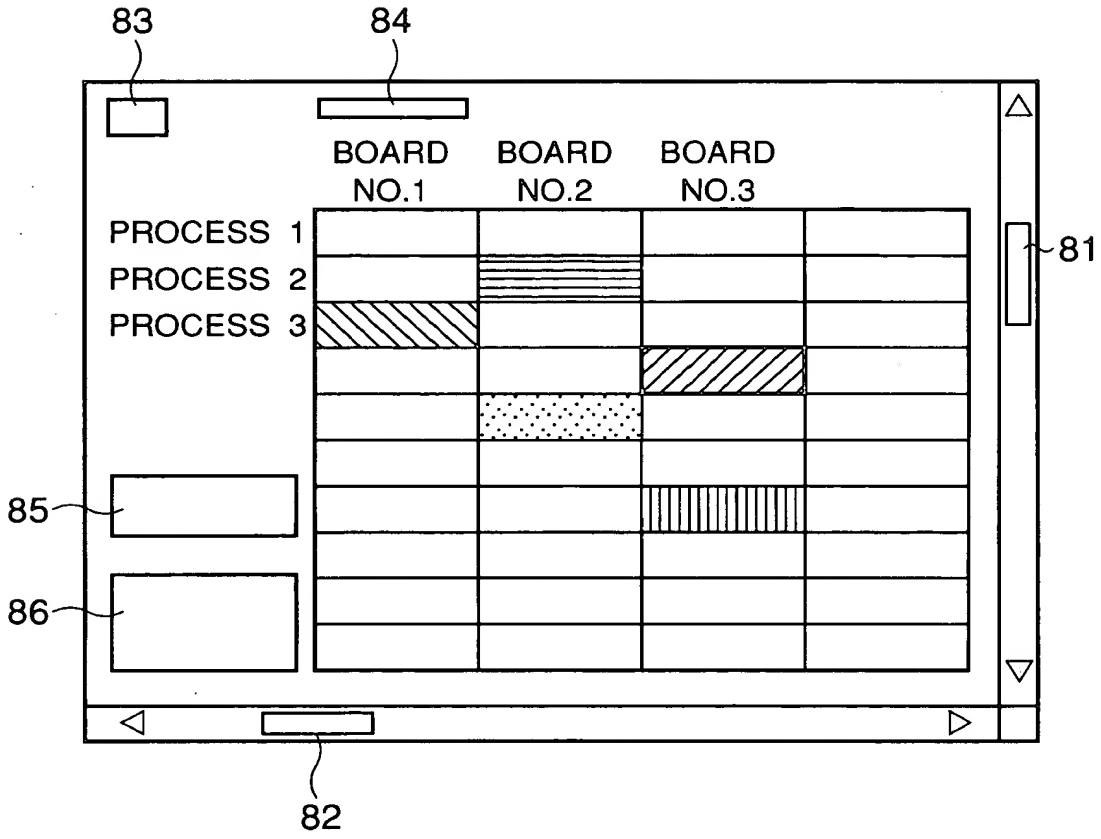

83
84
BOARD NO.1
BOARD NO.2
BOARD NO.3
PROCESS 1
PROCESS 2
PROCESS 3
81
85
86
82

FIG.20A

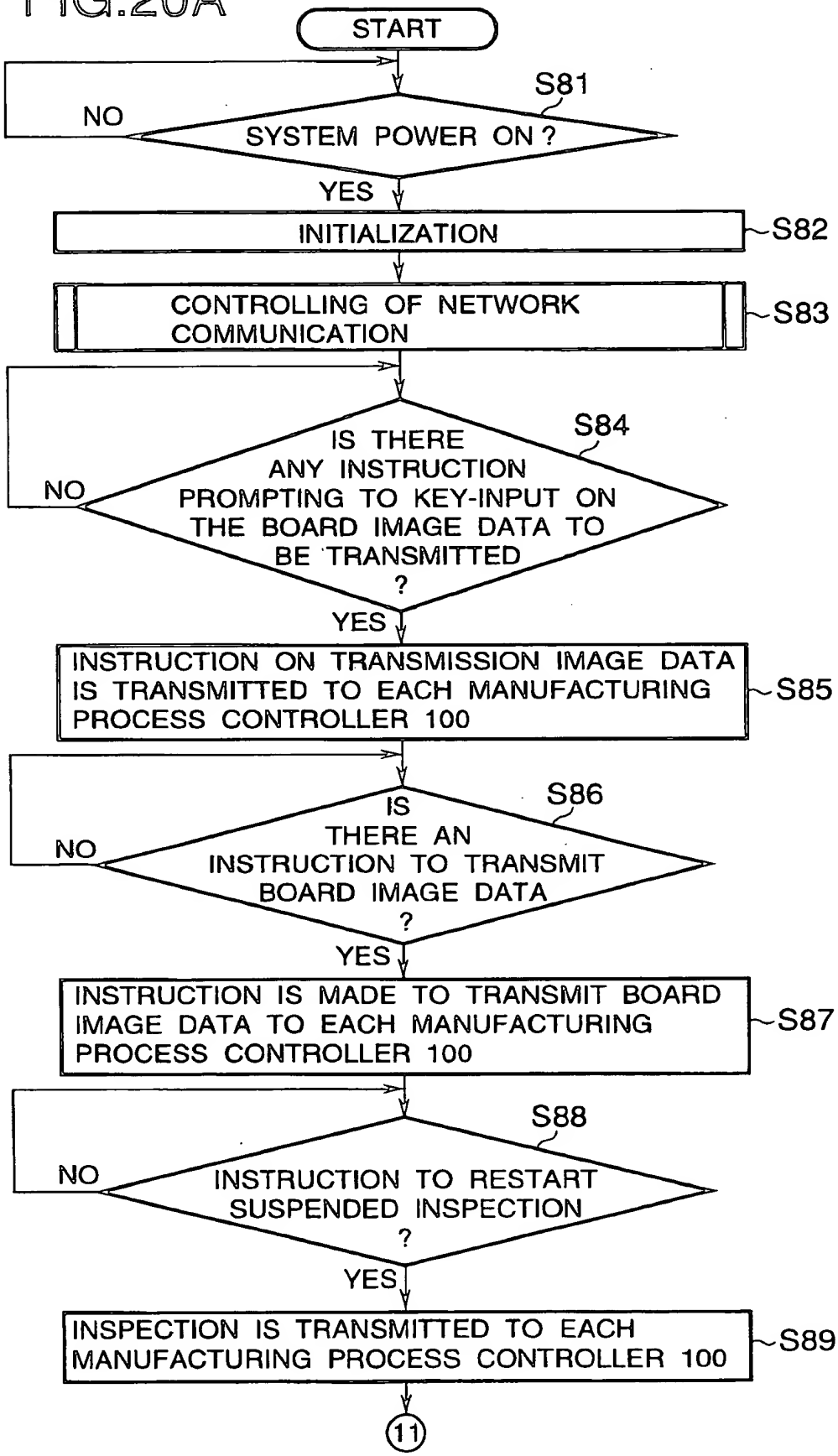

START
S81
NO
SYSTEM POWER ON ?
YES
INITIALIZATION
S82
CONTROLLING OF NETWORK COMMUNICATION
S83
S84
IS THERE ANY INSTRUCTION PROMPTING TO KEY-INPUT ON THE BOARD IMAGE DATA TO BE TRANSMITTED ?
NO
YES
INSTRUCTION ON TRANSMISSION IMAGE DATA IS TRANSMITTED TO EACH MANUFACTURING PROCESS CONTROLLER 100
S85
S86
IS THERE AN INSTRUCTION TO TRANSMIT BOARD IMAGE DATA ?
NO
YES
INSTRUCTION IS MADE TO TRANSMIT BOARD IMAGE DATA TO EACH MANUFACTURING PROCESS CONTROLLER 100
S87
S88
INSTRUCTION TO RESTART SUSPENDED INSPECTION ?
NO
YES
INSPECTION IS TRANSMITTED TO EACH MANUFACTURING PROCESS CONTROLLER 100
S89
11

FIG.20B

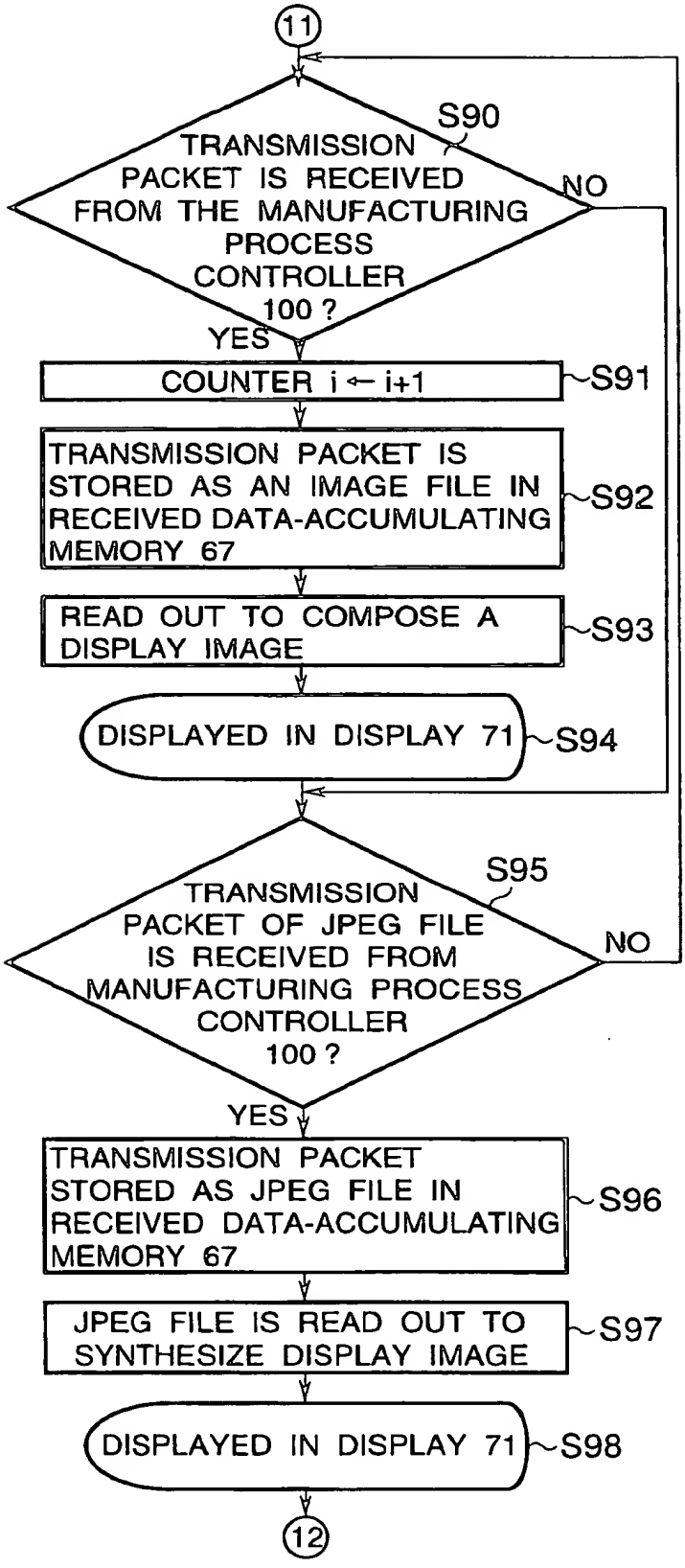
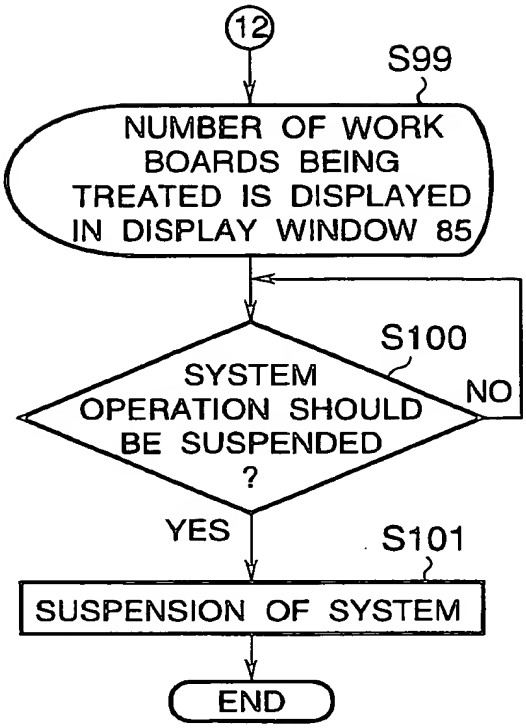



FIG.20C